

Figure 1

Accufflo2027 Aging at RT

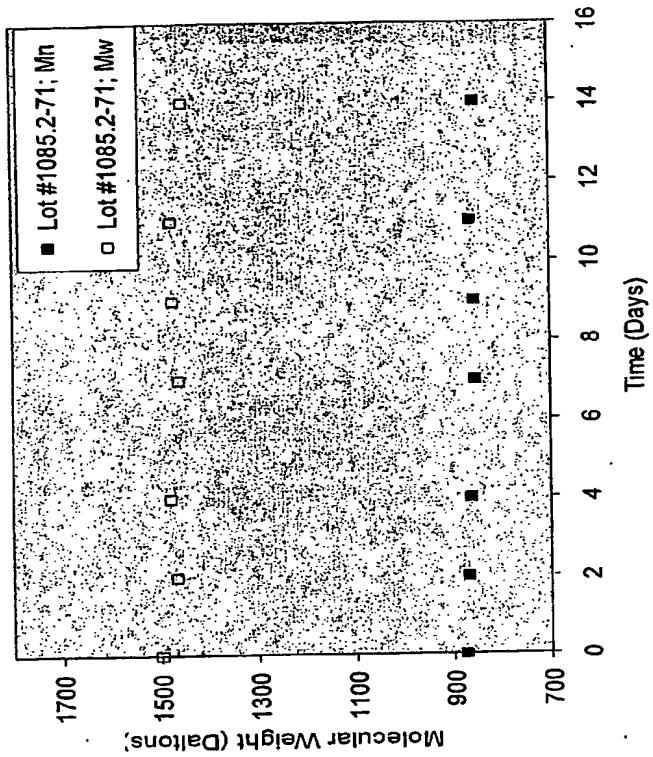


Figure 2

Accuflow2027 aging at 40C

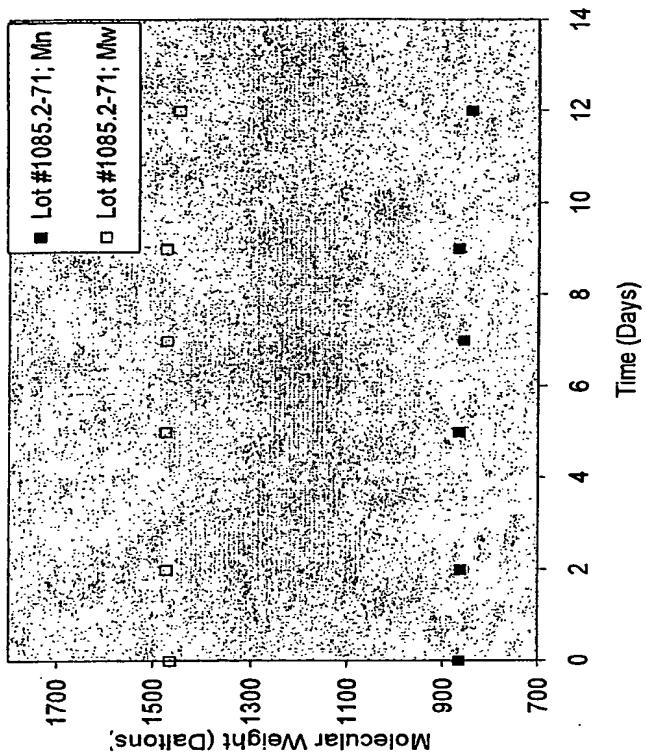


Figure 3

Table 1

Material	M _n	M _w	M _p	M _z	PDI
Accuflo 2025	870	1523	1256	2416	1.75
Accuflo 2027	862	1473	1218	2385	1.71

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Step	Time (s)	Speed (rpm)	Acc (rpm/s)	Dsp	Arm1	Arm2	Exh flow
1	1.0	0	10000		H, NW	H, NW	200
2	0.5	0	10000		H, NW	H, NW	200
3	0.5	0	10000	16	DD, W	H, NW	200
4	0.5	0	10000		DD, NW	H, NW	200
5	0.5	0	10000		DD, NW	H, NW	200
6	0.6	0	10000		DD, NW	H, NW	0
7	0.5	0	10000		center, 150mm/s, NW	H, NW	0
8	1.0	0	10000	2	center, 150mm/s, NW	H, NW	0
9	6.5	1000	10000		H, NW	H, NW	0
10	1.0	1000	10000	15	DD, NW	H, NW	0
11	0.6	0	10000		Disp 2, 150mm/s W	H, NW	0
12	10.0	2000	10000	1	Disp 3, 10 mm/s, NW	H, NW	0
13	5.0	800	2000		H, NW	H, NW	0
14	3.0	100	10000		H, NW	H, NW	0
15	5.0	300	10000		H, NW	H, NW	0
16	7.0	600	10000		H, NW	H, NW	0
17	8.0	900	10000		H, NW	H, NW	0
18	11.0	1200	10000		H, NW	H, NW	0
19	3.0	1500	10000		H, NW	H, NW	0
20	15.0	2000	10000		H, NW	H, NW	0
21	15.0	2000	10000		H, NW	H, NW	200
22	3.0	1500	10000	11,12	H, NW	WE, W	200
23	0.5	1500	10000	13	H, NW	WE, 3 mm/s NW	200
24	1.0	1500	10000	13	H, NW	WE, 3 mm/s NW	200
25	2.0	1500	10000	13,21	H, NW	WE, 3 mm/s NW	200
26	2.0	1500	10000	13	H, NW	WE, 3 mm/s NW	200
27	2.0	2000	10000		H, NW		200
28	1.0	0	10000		H, NW		200

Table 2

Recipe position data (mm)

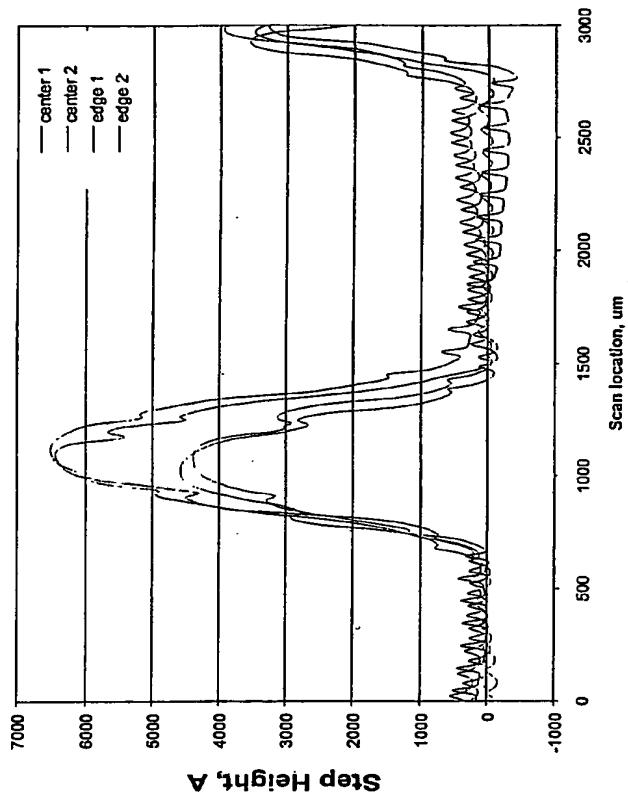
home	-57.91	dummy dispn	0	center	173.71
end	184.01	dispense 2	79.99	edge	79.99
		dispense 3	172.7		

Table 3

Dsp #	Dsp name	Solvent	Flow rate
1	SOD nozzle 1	Accufllo	0.45 ml/s
2	Solvent nozzle 2	PGMEA	0.60 ml/s
11	Inner cup rinse	PGMEA	300
12	Outer cup rinse	PGMEA	300
13	Edge bead rinse	PGMEA	30
15	Nozzle 1 rinse	PGMEA	30
16	Nozzle 2 rinse	PGMEA	30
21	Backside rinse	PGMEA	50

Table 4

Figure 4



Event	Time	RPM	ACC	DSP	Arm 1
1	0.5	0	10000		disp 1, 150 mm/s, W
2	0.5	1000	10000	9	disp 1, 150 mm/s, NW
3	3.0	1500	10000		disp 1, 150 mm/s, NW
4	3.0	1500	10000		disp 5, 150 mm/s, NW
5	5.0	1500	10000		disp 5, 150 mm/s, NW
6	0.1	1000	10000	4	disp 5, 150 mm/s, NW
7	14.0	1000	10000		center, 20 mm/s, NW
8	2.0	800	10000		center, 150 mm/s, NW
9	3.0	100	10000		home, 150 mm/s, NW
10	4.0	300	10000		home, 150 mm/s, NW
11	5.0	600	10000		home, 150 mm/s, NW
12	6.0	900	10000		home, 150 mm/s, NW
13	6.0	1200	10000		home, 150 mm/s, NW
14	20.0	2000	9000		home, 150 mm/s, NW
15	1.0	1000	10000		home, 150 mm/s, NW
16	5.0	1500	9500		home, 150 mm/s, NW
17	5.0	1500	9500	13,21	home, 150 mm/s, NW
18	4.0	1500	9500	13,21	home, 150 mm/s, NW
19	10.0	2000	10000	13,21	home, 150 mm/s, NW

Table 5

Pump recipe	
time	14 s
volume	6 ml

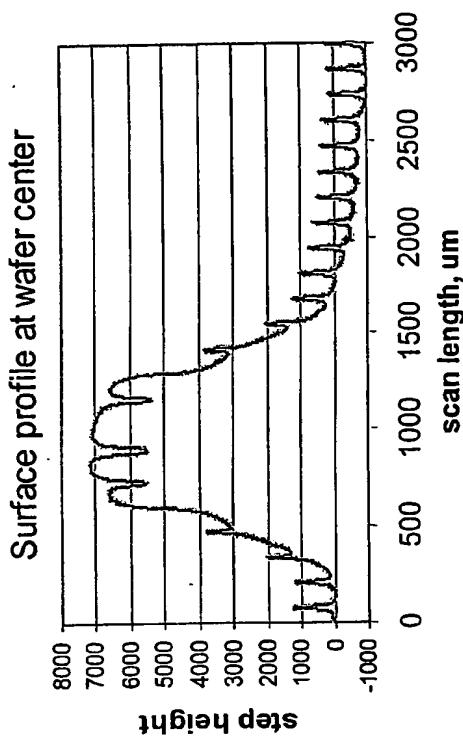
Recipe position data (mm)			
begin	89	center2	170.5
end	180	edge	87
center1	170	dispense 5	88
		dispense 1	170.5

Table 6

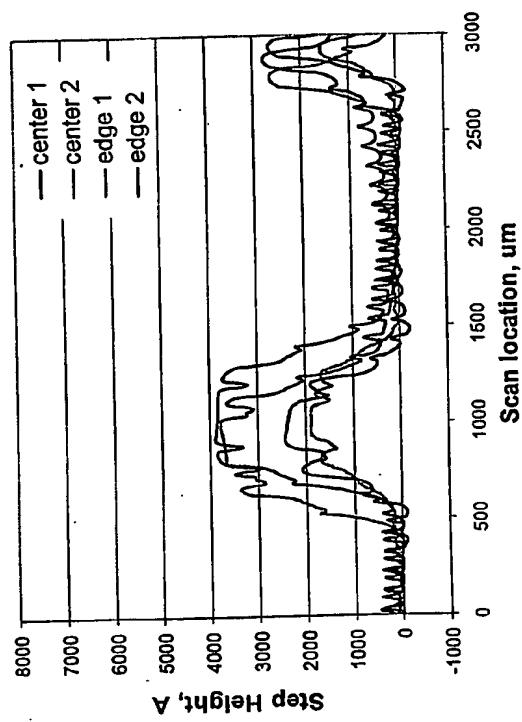
Dsp #	Dsp name	Solvent	Flow rate
4	SOD nozzle 1	Accuflo rev2	use pump recipe
9	solvent	PGMEA	PGMEA pressure 0.1 Mpa
13	back side rinse	PGMEA	-
21	Edge bead rinse	PGMEA	-

Table 7

Figure 5



Figure



Step	Time (s)	Speed rpm	Acc rpm/s	Dsp	Arm1	Arm2	Exh flow
1	1.0	0	10000		H, NW	H, NW	200
2	0.5	0	10000		H, NW	H, NW	200
3	0.5	0	10000	16	DD, W	H, NW	200
4	0.5	0	10000		DD, NW	H, NW	200
5	0.5	0	10000		DD, NW	H, NW	200
6	0.5	0	10000		DD, NW	H, NW	0
7	0.5	0	10000		center, 150mm/s, NW	H, NW	0
8	0.5	0	10000	2	center, 150mm/s, NW	H, NW	0
9	6.5	1000	10000		H, NW	H, NW	
10	1.0	1000	10000	15	DD, NW	H, NW	
11	0.5	0	10000		Disp 2, 150mm/s W	H, NW	0
12	14.0	2000	10000	1	Disp 3, 10 mm/s. NW	H, NW	0
13	5.0	800	2000		H, NW	H, NW	0
14	3.0	100	10000		H, NW	H, NW	0
15	5.0	300	10000		H, NW	H, NW	0
16	7.0	600	10000		H, NW	H, NW	0
17	7.0	900	10000		H, NW	H, NW	0
18	7.0	1200	10000		H, NW	H, NW	0
19	3.0	1500	10000		H, NW	H, NW	0
20	10.0	2000	10000		H, NW	H, NW	0
21	10.0	2000	10000		H, NW	H, NW	200
22	3.0	1500	10000	11,12	H, NW	WE, W	200
23	0.5	1500	10000	13	H, NW	WE, 3 mm/s NW	200
24	1.0	1500	10000	13	H, NW	WE, 3 mm/s NW	200
25	2.0	1500	10000	13,21	H, NW	WE, 3 mm/s NW	200
26	2.0	1500	10000	13	H, NW	WE, 3 mm/s NW	200
27	2.0	2000	10000		H, NW		200
28	1.0	0	10000		H, NW		200

Table 8

Dsp #	Dsp name	Solvent	Flow rate
1	SOD nozzle 1	Accuflo	0.45 ml/s
2	Solvent nozzle 2	PGMEA	0.60 ml/s
11	Inner cup rinse	PGMEA	300
12	Outer cup rinse	PGMEA	300
13	Edge bead rinse	PGMEA	30
15	Nozzle 1 rinse	PGMEA	30
16	Nozzle 2 rinse	PGMEA	30
21	Backside rinse	PGMEA	50

Table 9

Rcp position	Location, mm
home	-57.91
end	184.01
dummy	0
dispense 2	79.99
dispense 3	172.7
center	173.71
edge	79.99

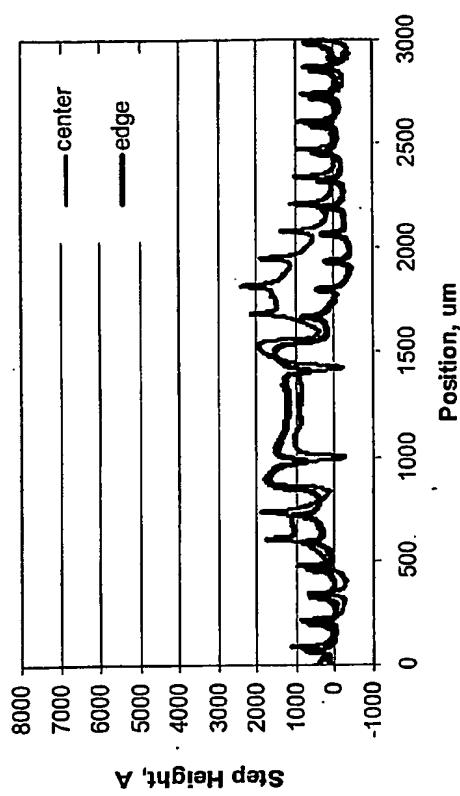
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Figure 7



Event	Time	RPM	ACC	DSP	Arm1
1	0.5	0	10000		disp 1, 150 mm/s, W
2	0.5	1000	10000	9	disp 1, 150 mm/s, NW
3	3.0	1500	10000		disp 1, 150 mm/s, NW
4	3.0	1500	10000		disp 5, 150 mm/s, NW
5	5.0	1500	10000		disp 5, 150 mm/s, NW
6	0.1	1000	10000	4	disp 5, 150 mm/s, NW
7	14.0	1000	10000		center, 20 mm/s, NW
8	2.0	800	10000		center, 150 mm/s, NW
9	3.0	100	10000		home, 150 mm/s, NW
10	4.0	300	10000		home, 150 mm/s, NW
11	5.0	600	10000		home, 150 mm/s, NW
12	6.0	900	10000		home, 150 mm/s, NW
13	6.0	1200	10000		home, 150 mm/s, NW
14	20.0	2000	9000		home, 150 mm/s, NW
15	1.0	1000	10000		home, 150 mm/s, NW
16	5.0	1500	9500		home, 150 mm/s, NW
17	5.0	1500	9500	13,21	home, 150 mm/s, NW
18	4.0	1500	9500	13,21	home, 150 mm/s, NW
19	10.0	2000	10000	13,21	home, 150 mm/s, NW

Table 11

Pump recipe	
time	14 s
volume	6 ml

Recipe position data (mm)			
begin	89	center2	170.5
end	180	edge	87
center1	170	dispense 5	88
		dispense 1	170.5

Table 12

Dsp #	Dsp name	Solvent	Flow rate
4	SOD nozzle 1	Accuflo rev2	use pump recipe
9	solvent	PGMEA	PGMEA pressure 0.1 Mpa
13	back side rinse	PGMEA	-
21	Edge bead rinse	PGMEA	-

Table 13

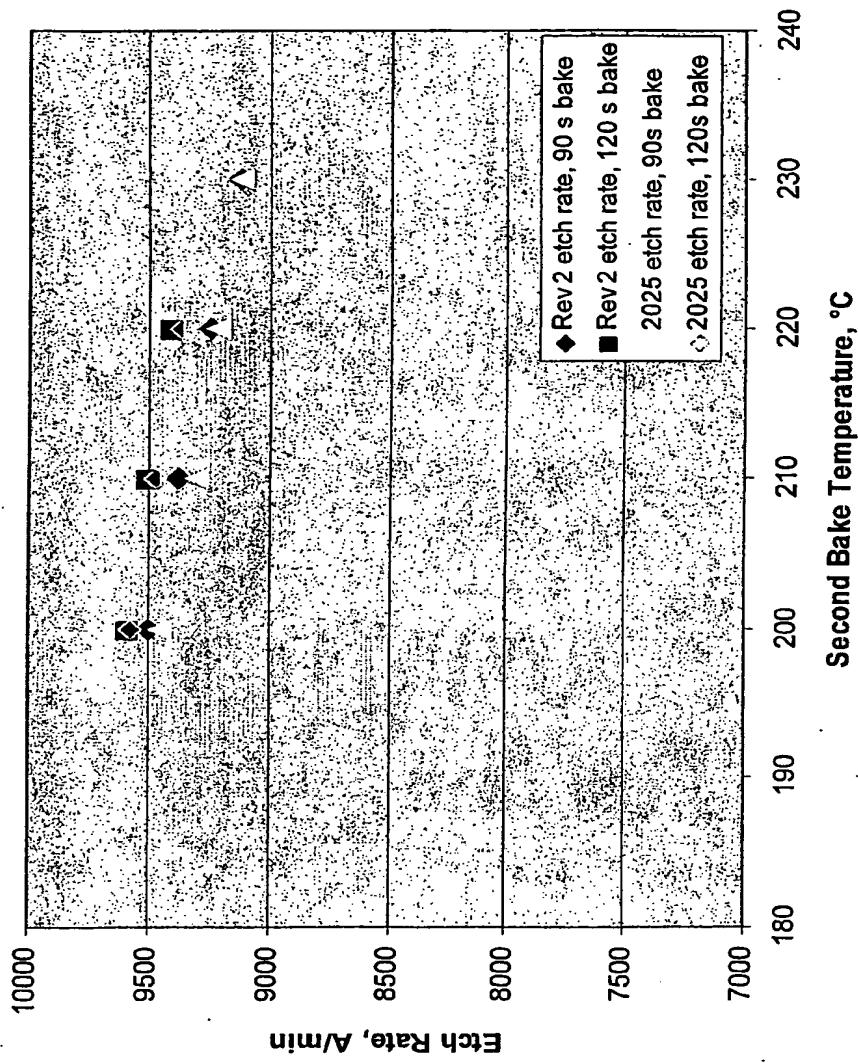
Accuflo 2027 TMAH Resistance

Sample#	Bake conditions	Th. Pre-TMAH Å	Th. Post-TMAH Å	Δ Thickness Å
1.1	160/180C 90s air	20605	0	20605
1.2	160/180C 90s air	20576	0	20576
2.1	160/200C 90s air	19898	0	19898
2.2	160/200C 90s air	19953	0	19953
3.1	160/220C 90s air	18511	3550	14961
3.2	160/220C 90s air	18540	4081	14459
13.1	160/230C 90s air	17826	17828	-2
14.1	160/240C 90s air	17862	17856	6
15.1	160/250C 90s air	17190	17168	22
7.1	160/180C 120s air	20495	0	20495
7.2	160/180C 120s air	20516	0	20516
8.1	160/200C 120s air	19626	0	19626
8.2	160/200C 120s air	19702	0	19702
16.1	160/210C 120s air	19440	0	19440
9.1	160/220C 120s air	18289	18295	-6
9.2	160/220C 120s air	18254	18247	7

Wafers were dipped two min. in 2.3% TMAH at RT.

Table 14

Figure 8



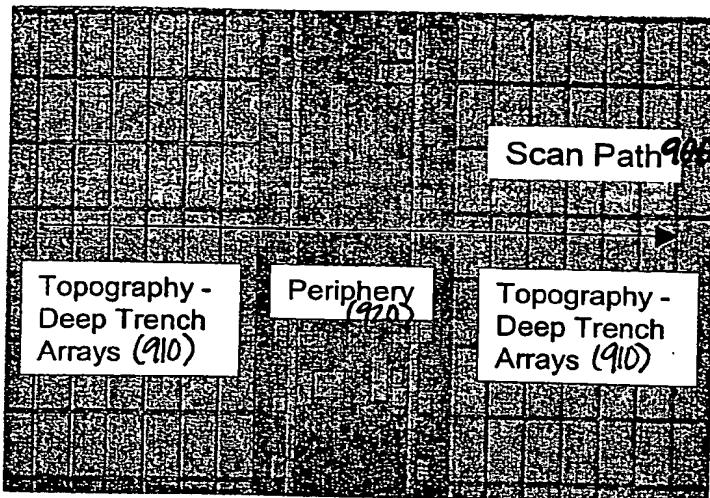


Figure 9

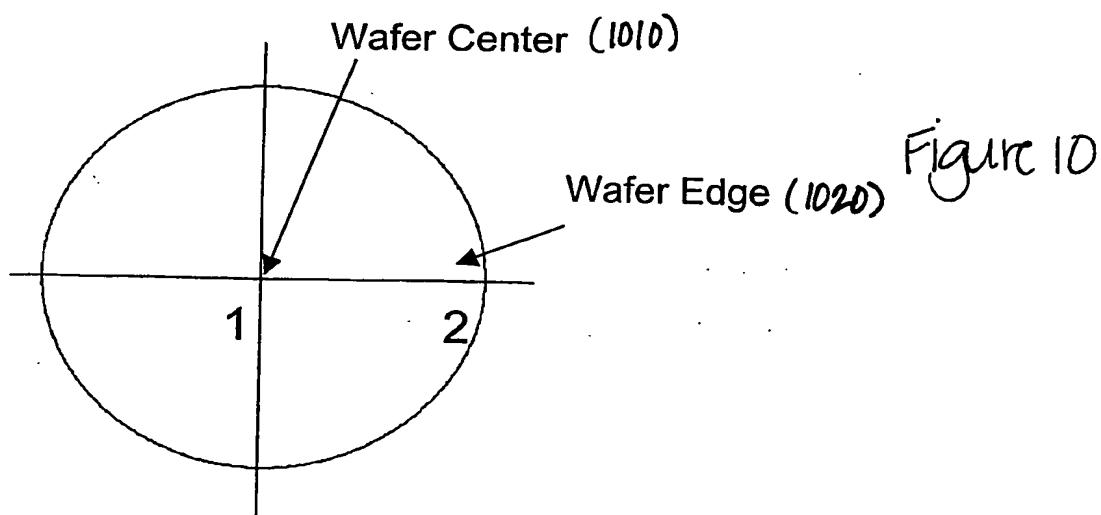


Figure 10

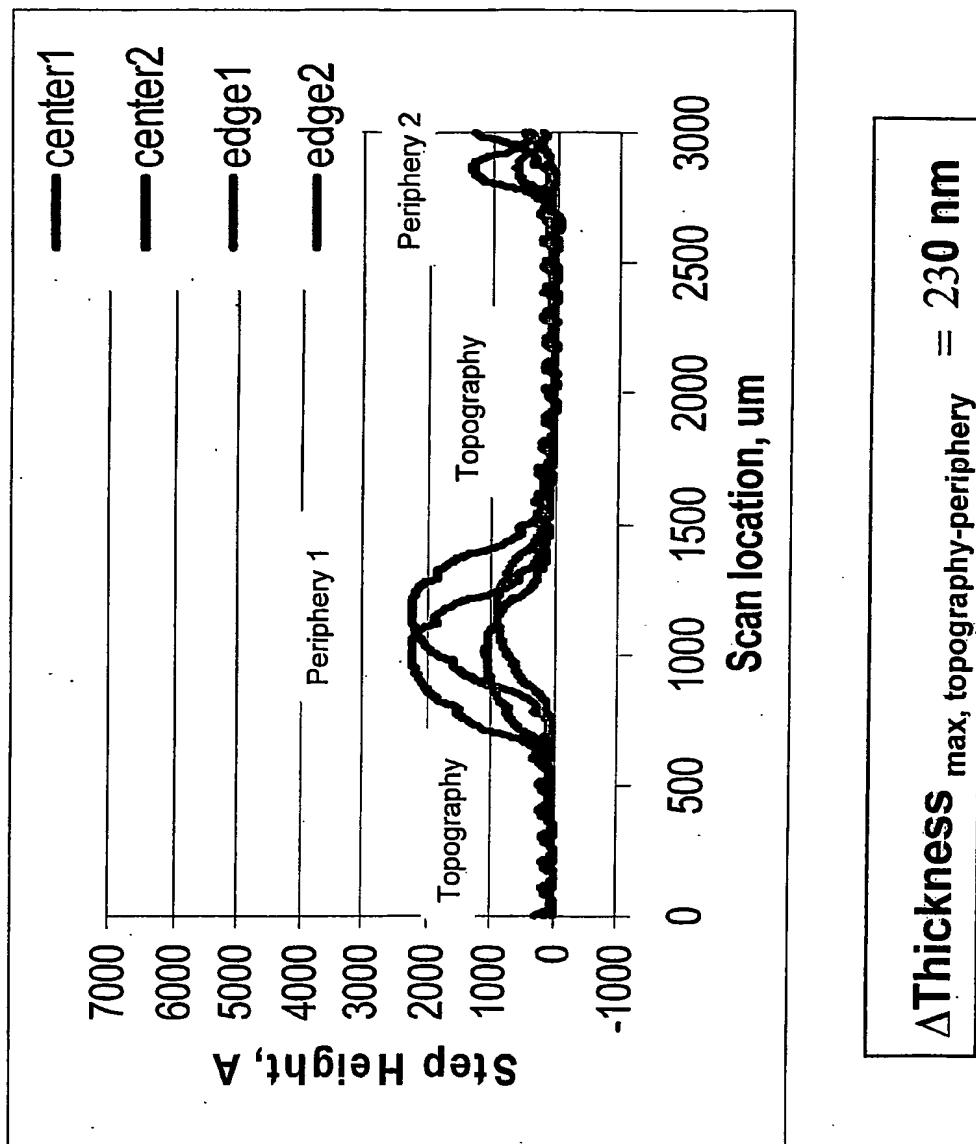
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Table 15

Material	Accuflo2025 and Accuflo2027 Rev2 Planarization Comparison					
	Δ Thickness trench array-support (nm)			Δ Thickness trench array-support (nm)		
	standard process	BKM process	BKM process	standard process	center	edge
	center	edge	center	center	edge	edge
Accuflo2025	200	200	200	200	200	200
1513EL	900	550	500	350		
Accuflo2027	600	400	300	200	150	150



Film thx. at various locations	Wafer Center, nm	Wafer Midpoint, nm	Wafer Edge, nm
Thx over trench array center	1910	1810	1810
Thx over trench array edge	1810	1810	1950
Thx over topography	1790	1860	1910
Thx over periphery	1860	1910	1950
Chip-level thx. diff.	120	100	140
Chip-level max thx. diff.		140	
Wafer-level max thx. diff.		160	

$$\Delta \text{Thickness}_{\text{max, topography-periphery}} = 160 \text{ nm}$$

Table 16

Run	Bake			Etchant	Exposure Time	Pre-etch		Post-etch	
	BP1	BP2	BP3			Thx, Å	RI	Thx, Å	RI
1	160°C (120 s)	180°C (120 s)		air	500:1 BOE	2 min			
2	160°C (120 s)	180°C (120 s)		air	500:1 BOE	5 min			
3	160°C (120 s)	200°C (120 s)		air	500:1 BOE	2 min			
4	160°C (120 s)	200°C (120 s)		air	500:1 BOE	5 min			
5	160°C (120 s)	180°C (120 s)	200°C (120 s)	air	500:1 BOE	2 min			
6	160°C (120 s)	180°C (120 s)	200°C (120 s)	air	500:1 BOE	5 min			
7	160°C (120 s)	200°C (120 s)	200°C (120 s)	air	500:1 BOE	2 min			
8	160°C (120 s)	200°C (120 s)	200°C (120 s)	air	500:1 BOE	5 min			
9	160°C (120 s)	200°C (120 s)	210°C (120 s)	air	500:1 BOE	2 min			
10	160°C (120 s)	200°C (120 s)	210°C (120 s)	air	500:1 BOE	5 min			

complete resistance to 500:1 BOE

Table 17

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